

‘You have to understand words . . . but not read them’: young children becoming readers in a digital age

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Given that many young children now enter their early years in education as competent and frequent users of digital technology, this paper examines how this experience influences children’s perceptions of reading. Drawing from research conducted with 12 young children (aged 3–6) this paper reports on the ways in which these children were interacting with screen texts and using them to develop strategies to make sense of a whole variety of symbolic representations, including print. It is argued that the medium of computer technology in particular was seen to encourage young children to develop both understandings about texts and the skills needed to read them. This included specific aspects of print awareness as well as a general confidence in handling print. However, this confidence appeared to diminish as the children encountered ‘schooled’ approaches to print literacy. It is therefore concluded that schools need to find ways in which to capitalise on the use of multimedia in order to promote confidence and skills in young readers today.

Research on reading has followed many avenues over the years, largely in a quest to understand why some children find it easier to learn to read than others and to find out what works best in terms of reading instruction (McGuinness, 2005). Until recently, much of this work has been grounded in the assumption that the term ‘reading’ relates almost solely to an ability to decode printed text within the context of paper-based media. Yet many now recognise that the nature of ‘literacy’ is changing (Bearne, 2003; Kress, 1997). Recent rapid developments in technology mean that digitised media in particular now penetrate the ‘textual landscape’ (Carrington, 2005) of children’s literary experience. As a result, accepted understandings of what is meant by the terms ‘reading’ and ‘being a reader’ have become challenged.

It has been widely documented that young children now enter the formal education system with a wide variety of experience in reading multi-modal texts (Carrington, 2005; Marsh et al., 2005). Given that the term *multi-modal* is being used in a social semiotic sense, recognising that ‘meaning and knowledge is built up through various modalities’ (Vasquez, 2005, p. 209) (such as image, sound, symbol and so on), it is clear that modern definitions of *reading* include abilities to read texts on screen as well as on paper. This was acknowledged in the recent UKLA document *Reading on Screen* which reported that ‘evidence from children as young as 5 shows sophisticated expertise in on-screen reading’ (Bearne et al., 2007, p. 27). While it is clear that the term ‘screen texts’ relates to

many different kinds of media, including television texts (Roberts & Howard, 2005), there is much to suggest that computer technology is especially prominent within children's current screen and multi-modal textual experience (Facer, Furlong, Furlong & Sutherland, 2003; Holloway & Valentine, 2003).

Yet it appears that the ability to read digital texts goes largely unrecognised in the literacy curriculum and its assessment (Bearne, 2003; 2004; Marsh, 2003; Pahl, 2002). It has therefore been argued that descriptions of reading development in the curriculum must be reviewed in order to reflect 'the skills and strategies which children bring to their understanding of screen texts' (Bearne et al., 2007, p. 29). However, it is apparent that detailed knowledge about the ways in which young children read screen texts is limited. Although there is clearly much more to be learned, this paper provides a valuable contribution to the debate, reporting findings from a three-phase longitudinal study designed to investigate how young children form constructions of reading during their earliest years within the formal education system. The overall study explored many different aspects of children's perceptions of reading; however this paper examines the ways in which the prevalence of digital media in modern society influenced these children's perceptions of reading and the implications this has for the teaching of reading today.

Perspectives on 'reading'

For some time now, researchers and educationalists have recognised that conceptualisations about literacy are in no way 'monocultural' (Street, 1984) and cannot be separated from the context in which the literacy occurs. In particular, much work has emphasised the importance of the child's home environment upon all aspects of language acquisition (Compton-Lilly, 2006; Maddock, 2006; Tizard & Hughes, 1984). It has been well documented that children are generally exposed to a far wider discourse on reading within the home environment, in comparison with school (Minns, 1997; Pahl, 2002). However, as Minns (1997) observed in her study of five preschool children, schools are reluctant to value the reading experience children engage with before entry into the formal education system.

This issue takes on a particular significance when we consider that children's preschool reading experience now includes substantial access to digital texts. Indeed Bearne et al. (2007, p. 11) noted that 'very young children show expertise in on-screen reading, even where homes may not have computers'. This suggests that many young children today demonstrate a broad proficiency in handling screen texts that is not confined to the use of computer texts within their own homes. In other words, it appears that children develop the skills to become 'digitally literate' (Glister, 1997) from their earliest years. Yet Merchant (2007) warns that vague conceptualisations of the term 'digital literacy' have obscured an understanding of how some aspects of screen-based communication are produced, presented and interpreted. Merchant goes on to stress that the term should relate to more than a general confidence in handling screen texts, but should be specifically orientated towards the 'study of written or symbolic representation that is mediated by new technology' (2007, p. 121). It should be stressed that within the context of this paper, the term 'digital literacy' is being used largely to describe the ways in which young children develop strategies to access and read a variety of screen texts with fluency; however this study acknowledges that the reading of letters and other symbols is intrinsic to study of children's interactions with digital texts.

Moreover, researchers recognise that acquiring skills in digital literacy is a sophisticated process that places specific demands on the reader. Bearne (2004, p. 16) states that texts are now available to young readers in a variety of modes and media 'so that "text" has come to include not only words-plus-images but moving images, with their associated sound tracks too'. This combination of words with photographic and moving image, sound and colour, particularly in the context of digital technology, has prompted researchers to challenge traditional constructions of reading and recognise that 'reading' is a broad and complex skill extending far beyond the ability to decode printed text within paper-based media.

It is widely recognised that while schools acknowledge that children use a variety of strategies to make sense of texts, *learning to read* is largely defined as 'learning to break-the-code of print' (Turbill, 2001, p. 274). Despite the impact of technological change on children's reading experiences, Jackie Marsh, in an interview with Kathy Hall, states that 'schools have been rather slow to recognise that changing landscape of communication. The school still hangs on to the printed text as the primary form of communication' (Hall, 2003, p. 173). But this perspective on reading is becoming increasingly regarded as outdated. Turbill (2002, p. 3) claims that a focus on reading as decoding print may have once 'served the cultural age in which it operated', but asserts that 'we cannot teach reading in this way in our current age'. Recognising the impact of new digital technologies on children's reading experiences, Turbill argues that learning to read is a 'far more complex process in the 2000s' than ever before and urges schools to accept the plurality of literacy in modern society.

Certainly this concept of 'multiliteracies' can be seen to include recognition of a wide range of multimedia and modes, but one must then ask – how does print reading fit within this broader construction of reading? This issue was recently explored by Hassett (2006), who challenged the use of traditional alphabetic print literacy by reframing constructions of early reading instruction within a context of new technologies and changing texts. Recognising that the early literacy curriculum and its assessment maintains 'a seemingly permanent notion of reading, writing and text that is tightly tied to alphabetic print concepts' (p. 96), Hassett argues that a reluctance to accept new forms of reading in education, 'has less to do with a "new" medium ... and more to do with the way that alphabetic print literacy discourses are maintained in education' (p. 82).

Hassett is therefore suggesting that early years educators need to recognise that children find meaning in the signs and symbols of texts that go beyond the traditional characteristics of alphabetic print. She concludes:

New forms of reading (in an ontological sense) require new types of readers (in a paradigmatic sense), where identity resources mix with knowledge resources to support the reader in making smart and meaningful choices. The idea that meaning is fixed in the combination of letters on the page and deciphered in the head is not nearly as helpful in situations where meaning needs to be negotiated by thinking heads in social relations (Hassett, 2006, p. 96).

In other words, Hassett appears to be arguing that print-literacy skills need to become embedded within a broader discourse on reading, which values all sign and symbol systems in texts. But how does this translate into a new reading curriculum for children? Recognising that young children are 'immersed in practices relating to popular culture, media and new technologies from birth' (Marsh et al., 2005, p. 5), Marsh et al. stress:

There is now a need for educators to respond to the challenge this presents by developing curricula and pedagogy which enable children to build on their digital 'funds of knowledge' (Moll, Amanti, Neff & Gonzalez, 1992) and provide them with opportunities to engage fully with the technological, social and cultural demands of the knowledge economy.

Educators cannot however develop curricula and pedagogy that builds upon children's digital 'funds of knowledge' until more is known about the ways in which children read digital texts and how this compares with the reading of paper-based texts. For this reason, the study reported in this article aimed to investigate how the young children participating in the project were developing strategies to read and make sense of digital texts within a variety of different contexts. In particular, given that schools still regard printed text as 'the primary form of communication' (Hall, 2003, p. 173) the study examined how the children's perceptions of print literacy were influenced by the use of digital media. In order to gain insights into the children's perspectives, a stringent methodology was developed, whereby a range of age-appropriate activities were designed and implemented to gain valid and reliable data directly from young child participants.

Methodology

The project charted the journeys of two separate cohorts of children from the same primary school in East Anglia; six from Nursery (three girls and three boys) and six from Reception (three girls and three boys). As it was understood that any of the children in the classes would have offered valuable and unique data, the selection of children was governed largely by practical concerns rather than specific methodological issues. For example, as rates of mobility were high within the school, any child who appeared likely to move from the area during the period of data collection was not included in the sample. Given that issues of gender have indeed been identified as relevant to children's perceptions of reading (Millard, 1997; Moss, 2007) and older children's use of computer technology (Facer et al., 2003; Holloway & Valentine, 2003) equal numbers of boys and girls were included in the sample. Furthermore as it was deemed inappropriate to include Reception children who had participated in the pilot study, these children were not selected. An attempt was also made to include some children for whom English was a second language, in order to reflect the ethnic diversity of the school. Once these criteria had been satisfied the final selection was made on the basis of age, so that the sample included children whose birthdays spread throughout the year.

Given that it has been acknowledged that 'the best source of information about issues pertinent to children is the children themselves' (Scott, 2000, p. 106), interview-based tools were designed to facilitate the acquisition of valid and reliable data directly from children as young as 3 years old. Careful attention was given to both the design and implementation of these tools, in order to access the 'voices' (Cremin & Slatter, 2004) of these young children. Data were collected in three phases over the course of one complete academic year as shown in Table 1. Much of the data were collected directly from the children, using a range of age-appropriate participatory techniques; however, teachers and parents were also interviewed to provide the study with a broader context. This meant that as the study progressed, profiles could be created for each child on the basis of data

collected from the children at home and at school, direct observation and interviews with parents and teachers.

Over the course of the year, a wide variety of different research activities were conducted both in the children's homes and within the school environment in order to explore the children's perceptions of reading. It is not possible to present each individual activity within this paper as there were too many to describe in detail; however the next section presents an overview of those specifically used to explore the children's interactions with digital media.

Research tools

Home visits were conducted in order to observe the children's interactions with digital media in the home and allow parents to speak about such interactions, yet much of the data were collected from the children themselves within the school setting. This involved the use of three main activities; the *Charlie Chick* Interview, *Small World Play* activity and the *Computer Assisted* Interview (see Table 2), all of which were repeated throughout the three phases of data collection. All of the activities were guided by semi-structured plans, which ensured that while the design allowed for certain themes to be explored and

Table 1. Overview of data collection.

Phase	Data collection	Year groups
1 Summer 2005 (May–July)	Children – Two-part interview (school) Small world play activity (school) Unstructured interview (home) Teachers – Interview Parents – Interview in home	Nursery and Reception
2 Spring 2006 (January–April)	Children – Interview (school) Computer assisted interview (school) Observation (school) Teachers – Interview (new teacher)	Nursery moved to Reception Reception moved to Year 1
3 Summer 2006 (May–July)	Children – Interview (school) Small world play activity (school) Unstructured interview (home) Parents – Interview in home	Reception and Year 1

Table 2. Overview of school-based activities with children.

Phase	Activity	Name	Method	Sub-activities included
1	1 (Part 1)	Charlie Chick Part 1	Interview	Learning Skills
	1 (Part 2)	Charlie Chick Part 2	Interview	Book and Screen (A) Computer-assisted
2	2	Small World Play	Research conversation	Learning Skills
	3	Charlie Chick	Interview	Book and Screen (B) Small World Play
	4	Computer-Assisted Interview	Interview/Observation	<i>Sebastian Swan</i> <i>Bob the Builder</i> Learning Skills
3	5	Charlie Chick	Interview	Learning Skills

revisited, each session could also be led by the individual comments and interests of each participating child.

The *Charlie Chick* interview involved the use of a glove puppet, to mediate a conversation between researcher and child. Within this conversation the children were asked to tell the puppet about the various activities they engaged with at home and at school, including their use of digital technology. As seen in Table 2, this interview also included two further sub-activities: *Learning Skills* and *Book and Screen*. In the *Learning Skills* activity the puppet presented the children with a set of photographs, each showing the same child engaged in an activity. The children were told that the child in the photographs was *learning* to perform the various skills presented below:

- Riding a bike
- Reading a book
- Running
- Tying shoelaces
- Reading words on a computer screen
- Painting a picture
- Writing words with a pencil
- Writing words on a computer

The children were then asked to decide whether they thought it was ‘easy’ or ‘hard’ to learn to do the activity before placing the picture in a corresponding pile. Some children chose to include a ‘middle’ pile when performing the activity so they could choose from three groupings rather than just the two.

The *Book and Screen* activity used a picture of a child reading a book (Figure 1) and a second picture of a different child (but of the same gender) reading from a computer screen. The actual computer screen was not visible in the photograph, so as to avoid the children’s responses being influenced by the presence of a particular game or program.



Figure 1. Picture of child reading a book in *Book and Screen* activity.

Through the medium of the puppet the children were asked a series of questions to investigate their perceptions of reading paper and screen-based texts. Examples of the questions asked are:

- Which child is having the most fun? Why?
- How does the child understand what is happening on the computer/in the book?
- Is it easier to read the words on the computer screen, in the book, or is it the same?
- Does this child like reading the words on the computer/in the book? Why?

Small World Play artefacts were also used regularly in the study to facilitate play-orientated research conversations by creating a ‘home scenario’ as a basis for role-play. As this scenario included a television, video and computer as well as general household furniture (tables and chairs) and a family of dolls, the activity encouraged the children to talk about the ways in which they perceive technology to be used within the home environment. The following extract shows how the presence of the computer in the *Small World Play* activity encouraged Kelly (4 years old) to talk about her own interactions with computer technology in her home.

K: I’ve got one of these at my home

I: Have you really?

K: Yes a real one – but it hasn’t got a twirly chair like that

I: So have you got one of these things too (pointing to the keyboard)?

K: Yes – you know my dad can get CBeebies on the computer too

I: What is CBeebies?

K: It’s what’s on TV and on the computer

I: Is it more fun when CBeebies is on the television or on the computer?

K: On the television and the computer

I: So when you’re playing CBeebies on the computer, do you use this (the keyboard) or this (the mouse) – or perhaps something else?

K: Well when you use CBeebies you use the mouse and when I do ... dad can get writing on it and it can do that.

I: There’s writing on it! Can you read any of the writing that is on the computer?

K: No. I only can do my name on there.

I: Can you? How do you do that?

K: I ... em ... there’s writing on the ... em ... one of these (points to the keyboard) and that gets my name

Finally, the children were also presented with opportunities to use computers as part of the data collection. In the first phase of the study they were asked to ‘show’ the glove puppet how to use the computer. Although the children were given opportunities to download games of their own choice, specific games were also chosen in advance of the activity. In the first phase, the children were encouraged to play a *Humpty Dumpty* game, where they were invited to create a nursery rhyme-type story by making selections from various options available on screen. This game offered the children a range of visual and auditory cues in order to guide their progress through the game.

In the second phase of the study the children were encouraged to play two games: *Sebastian Swan* and *Bob the Builder*. The first game featured a series of ‘big books’, similar to those regularly found in infant classrooms. The children were encouraged to

look at the books in any way they chose. As the game featured 'books' that were very similar to paper-based books (by clicking on an icon, the pages could be turned), this activity provided an opportunity to investigate whether the physical medium of the computer encouraged the children to interact differently with the books, in comparison with paper-based books. The second computer text featured a series of four games downloaded from the *Bob the Builder* website, which the children were invited to play. As highlighted in Table 3, these games displayed a variety of cues including iconic symbols, print, auditory cues and moving images.

These activities all provided opportunities to investigate the strategies used by each child in order to make sense of the texts. It was, of course, recognised that the extent to which the children were able to use the computer with independence would depend upon previous experience with computers. As a result, the activity was guided by the children themselves and support was offered whenever required.

Data analysis

All of the interviews were transcribed and grouped together for each child in the study. This meant that by the end of the first phase of the research, analysis could begin on the collection of transcripts relating to each individual child, including those conducted with parents and teachers. The challenge at this stage was to find a way of managing the data without imposing too many constraints on the latter stages of analysis. Given the exploratory nature of the study, data analysis at this point needed to be both reductive, in terms of categorisation, but simultaneously allow for unforeseen findings to emerge within the second and third phases of the study. For this reason, it was decided that the data would be coded using only four broad themes; however these themes were extended as the study progressed.

Each transcript was manually coded, using a different colour to highlight data pertaining to each of these four themes. This information was then collated through the medium of a profile that was written for each child on the basis of these four central themes. Once all 12 profiles were written, the profiles themselves underwent a further stage of reduction within the context of 'Across-case analysis'. This allowed for patterns to be identified across the profiles, on the basis of these themes. As well as being evaluative, this process opened the study to new avenues of inquiry and thus informed future phases of data collection. As the themes were refined and extended, this process facilitated the generation of theory.

Results

In concurrence with previous work (Bearne et al., 2007; Marsh et al., 2005), the results of this study indicated that these young children (details presented in Table 4) were reading a wide variety of multidimensional texts within many different contexts and settings. The following section now explains how the children were interacting with digital technology and reading computer texts in particular. Given the current emphasis on print literacy within the reading curriculum, this paper now describes how the children's perceptions of print reading were influenced by the use of digital media.

Table 3. Using the Bob the Builder games.

Name of game	Objective	Keyboard tools used	Moving image	Auditory cues	Examples of iconic symbols	Examples of print
Muck's Maze	To steer a truck through a maze	Arrow keys	Controlled by player	No	'Home' symbol, 'Muck's Maze' icon	Back, Start, Finish, Play again?, Yes, No
Slider puzzle	To reassemble a jumbled picture	Mouse	Controlled by player	No	'Home' symbol, 'Slider puzzle' icon	Show hints, easy, medium, difficult, back
Spud and Pickle	A game of 'noughts and crosses', but with characters	Mouse	Controlled by player	No	'Home' symbol, 'Spud and Pickle' icon, character icons	You win, you lose, Play again?, Select a level
Scrambler's Ramble	To race a truck and collect 'sunflowers'	Arrow keys	Yes	Yes	Truck, 'Home' symbol, 'Scrambler's Ramble' icon	Help, Play Back, Ready, Steady Go, number scores

Table 4. Children’s details.

Name*	Class**	Birthday	First Language
Malcolm	Reception	August	English
Toby	Reception	November	English
Simona	Reception	February	Spanish
Imogen	Reception	October	English
Annie	Reception	June	English
Joseph	Reception	February	English
Kelly	Nursery (Morning)	December	English
David	Nursery (Morning)	November	English
Huda	Nursery (Afternoon)	July	Arabic/English
Caitlyn	Nursery (Afternoon)	November	English
Shaun	Nursery (Morning)	September	English
Ibrihim	Nursery (Afternoon)	October	Bengali

Notes. *Pseudonyms have been used for reasons of confidentiality. ** Class at beginning of the study.

Digital literacy

It was clear from the outset that many of the children from both the Nursery and Reception cohorts were not only competent users of digital technology but had developed a transferable *literacy*, meaning they had acquired skills allowing them to operate unfamiliar technologies with fluency. This was especially apparent in the cases of two boys: Shaun (Nursery) and Joseph (Reception). Despite having had little exposure to computers within the context of their own homes, both boys were seen to have developed the skills needed to access and use computers in school, through their interactions with other multimedia in their homes.

For example, Shaun’s engagement with interactive technology in the home appeared to be confined largely to the context of game-play using the television (interactive games on Sky), small hand-held games consoles and the mobile phone. Yet Shaun’s teacher reported that Shaun had a particular interest in using the computer in school, stating that he will ‘spend ages on some games’ and ‘can do loads on the computer’, despite having received very little instruction in how to use the computer within the school context. It therefore appears that although Shaun’s exposure to computer technology within his home environment had been minimal, he had developed a degree of digital literacy through his interaction with other multimedia, which was transferred into the school setting and applied to the context of the computer.

It was also evident that many of the children in the study were able to apply the skills they had developed in using a PC in their home to the medium of a laptop computer in school. For example, it was clear that many of the children were not familiar with the *touch pad* (a pressure-sensitive pad commonly used on laptops as an alternative to the mouse), yet once they understood its relationship to the mouse on the PC, they were able to use it effectively.

Furthermore, on many occasions the children were asked to not only handle computer systems with which they were unfamiliar, but were also asked to demonstrate how to use the computer through the context of unknown games and programs. Yet it was clear that the children who were experienced in using computers had little difficulty in applying

their previous knowledge of computer game-play to the context of these ‘new’ screen texts. For example, having reported that they regularly accessed children’s websites at home, many of these children were seen to quickly grasp the objective of the *Humpty Dumpty* game and were observed making purposeful and independent selections from the icons on the screen in order to create their stories. This is illustrated in these notes taken from Huda’s (aged 3) profile:

Even though she had little experience using a laptop, Huda had no difficulty in following the structure of the *Humpty Dumpty* game and immediately began to use the *touch pad* to click on relevant icons. Without any adult intervention, she seemed to quickly grasp the purpose of the game and showed great delight in making her selections in the creation of a story. All her selections seemed to be purposeful, for example before clicking on ‘the beach’ option, she said, ‘I want the beach – I think this is where he’d like to go’.

The young children in this study had clearly not only learned how to make sense of digital texts, but also had developed transferable skills, allowing them to access a range of texts with independence. This suggests that young children may already be entrenched in the communicative practice of multi-modal discourse (Kress & van Leeuwen, 2001) before they even begin formal schooling. Yet this raises questions about how young children learn to read screen texts and how this understanding can influence the teaching of reading within the digital culture in which children live today. Given the proliferation of computer technology, this question is now addressed in reference to the reading of computer texts.

Reading computer texts

Findings revealed that most of the children in this study were using a whole variety of multi-modal cues including picture, symbol, sound, colour and print in order to access and use computer texts. Yet rather than viewing these cues as independent features, the children appeared to access meaning from computer texts in a ‘holistic’ sense, using a variety of cues simultaneously.

Firstly, most of the children clearly understood the meaning of many symbols on the computer although the language they used to describe the symbols was unique to each individual child. For example, it was evident that the ‘e’ symbol for *Internet Explorer* had meaning for Huda even though she did not fully comprehend the function of the Internet. She reported that the sign ‘means *CBeebies*’ which she explained ‘have lots of games there – and puzzles’. Moreover Simona reported that the *timer* symbol ‘means you have to wait’, while Joseph stated that the same symbol meant ‘don’t touch it’. Many of the children were also observed spontaneously clicking on the *English Flag* symbol when entering a program even though they did not all know what the symbol really stood for. For example Malcolm reported that this symbol was something that ‘helps it to load up’. In fact that symbol allowed the game to be accessed in English, as opposed to other language options, but Malcolm had evidently realised that this icon did indeed need to be clicked in order for the game to ‘load’.

Responding to print on screen

These examples illustrate the ways in which the children in this study were making meaning from pictorial symbols and icons within the context of computer screen texts. However, not only were the children making meaning from iconic symbols and pictures but appeared in many cases to be making sense of printed prompts in much the same way. This was particularly apparent amongst the Nursery children during the first Computer Assisted interview. For example when Ibrihim was showing Charlie Chick how to use the computer he came upon the two printed options 'Play' and 'Exit'. Despite the fact that Ibrihim claimed not to know what the words 'said', he confidently selected the 'Play' option. When asked how he knew to select this option he replied, 'I just know'. When then asked what would have happened if he had chosen the other option he responded, 'It stops'. This demonstrates that even though Ibrihim could not decode the print, he understood the meaning of the words in this context and was able to use the printed prompts to access his game.

Moreover, having created her story in the *Humpty Dumpty* game, Caitlyn was faced with the words 'The end. Do you want to see your story again?' For some reason there was no sound on the computer during this particular interview so Caitlyn was unable to use sound cues to help her elicit meaning from the text. When asked what she thought the words said, she replied, 'When you click on this one you make it come on again'. Once again, although Caitlyn was not accurately decoding the print, she obviously had a strong sense of what the words could reasonably say in this context and was therefore able to abstract meaning from the print, given that the print was not accompanied by any other iconic image.

Many of the children reported that they understood the meaning of printed prompts that appeared regularly on screen even though they could not decode the print. For example the options 'Play' or 'Play again?' were reported to be 'Start' or 'Go'. The 'Home' icon was often recognised by the children and reported to mean 'Back' or 'Stop'. Finally, many of the children were observed clicking on the icon 'Games' which appeared regularly on screen, especially during the final phase Computer Assisted interview. Once again even though they did not know what the word *said*, they clearly understood that the icon would lead them into the games page. As Joseph pointed out, this particular icon was often distinctive because of the colour surrounding it. He reported that he knew this said 'Games', 'because it's orange and it's got writing on it'.

This suggests that the children in this study were very often able to acquire meaning from print in much the same way as they would acquire meaning from pictorial or symbolic icons within the context of the computer screen text. How exactly they came to develop these understandings remains unclear; however there is evidence to suggest that one way was through the employment of a 'trial and error' strategy. This was observed for example when Malcolm was attempting to access the *Humpty Dumpty* game in the first phase of the study. Malcolm knew that he had to click on an icon to access the game but did not know which to choose from the icons presented on the desktop. He then employed a 'trial and error' technique, clicking on different printed prompts then working his way back to the desktop when he realised that his attempt to access *Humpty Dumpty* had been unsuccessful. Moreover, Malcolm did not appear at all concerned by these failed attempts. On the contrary he appeared very engaged with the process and was keen to try out new ideas, saying, 'I know (laughs) – maybe you have to try . . . something else. Maybe that one isn't really our – maybe we need the video or something'. When

Malcolm eventually found the menu to the *Humpty Dumpty* game he became very excited and was clearly proud of his accomplishment in finding his way into the game.

Malcolm was by no means the only child observed using 'trial and error' techniques in this way. Indeed Huda, Caitlyn and Joseph were all observed employing such techniques particularly when faced with printed options that they did not know. Yet all of the children appeared comfortable in using these self-regulatory strategies and seemed to know how to reverse their selections should they find themselves on a page that they did not want. This suggests that one of the ways in which young children may be making sense of print within computer texts is by *trying out* the print to see if it *works* in a practical sense. This suggests that the more children are allowed to work with print in this way, the more familiar they may become with the meaning (or function) of print.

It therefore appeared that many of the children in this study who were not yet print-literate, and could not decode print, had developed skills that allowed them to *use* print within the context of computer texts. These children appeared to be entirely comfortable with the fact that they were *using* print alongside pictorial and symbolic images, rather than actually *decoding* it. This differed significantly from further findings within the study, relating to the children's perceptions of book texts. Indeed data collected from all of the children suggested that they thought print within book texts needed to be rigorously decoded. For example Simona reported that in order to be a *reader*, Charlie Chick would have 'to read every word' in books if he was to 'act like a big boy ... properly with books'. Moreover Annie told Charlie Chick that he could look at pictures in books, but 'the words is for reading'. What is more, many of the children who also reported that they did not regard themselves as 'readers', or saw themselves as weak or partial readers, appeared somewhat inhibited about the presence of print in books (Levy, 2008). Yet these same children seemed largely comfortable in using print within the context of computer texts, especially during the early stages of the study.

The project data therefore strongly suggested that exposure to computer texts allowed many of the young children in this study an opportunity to develop confidence in handling print. It appeared that this was largely related to the print being used holistically as one of many symbolic modes on the path to meaning and did not carry a specific requirement to be decoded. Yet the study also suggested that this confidence was at risk of disruption when these children moved to a more formalised approach to reading in Reception.

Print reading and school discourse

The results of this research revealed that even though many of the children were observed competently using print to make meaning from computer texts, many lost confidence in handling print within paper and screen contexts over the course of the study. This appeared to be particularly the case when the Reception cohort moved into Year 1; however such findings were also evident amongst some of the Nursery cohort.

During the first phase of the study, Caitlyn was observed confidently using print within computer texts even though she was unable to decode it. This was also echoed in Caitlyn's mother's comments when, speaking of Caitlyn's ability to use one particular computer text unaided in the home, she stated, 'I don't know how she does it actually, because it has got writing in it'. By the second phase of the study though, Caitlyn was reporting that reading words on the computer was just as hard as reading words in books,

'because it's the same as the computer, but it's just a different thing'. She then further reported that even writing words on the computer was 'hard' because 'when you spell things you have to try and read them too'.

It should be noted at this point that Caitlyn had also been observed skilfully using pictures in books to create sophisticated narratives, during the first phase of the study. However, as the study progressed she was seen to reject such strategies to make meaning from books, believing that this did not conform to a *correct* definition of reading. In other words, Caitlyn was seen to lose confidence in many of her own strategies to acquire meaning from texts, as she became increasingly concerned that 'real' reading was about decoding print in books and seeing if 'the right letters' could be 'sounded out' – something she also reported to be 'hard' and requiring a great deal of 'practice'.

This demonstrates that even though Caitlyn remained very positive about using computer texts throughout all three phases of the study, her anxieties about reading print in books seemed to intrude upon her interactions with print in screen texts also. This may also explain why, by the third phase of the study, Caitlyn appeared more comfortable in using the computer at home rather than in school. While her mother reported that Caitlyn had become 'so proficient' in using many games on her computer at home, including games that were intended for Year 3 children, her teacher was simultaneously reporting that she is 'not overly' interested in using the computer in school.

Similarly Malcolm was reported as having an interest and a competence in using the computer throughout all three stages of the study, yet despite an apparent ability to use print and symbol together to make meaning from computer texts, he was also observed trying to decode print phonetically when using the computer in school. By the final stage of the study, even though Malcolm's teacher reported that he 'is more confident with that (the computer)' than paper-based activities, it appeared that Malcolm's confidence in reading computer texts had lessened. Having reported that *learning to read words on the computer* was a 'middle' rating in the Phase 2 *Learning Skills* activity, this was categorised as 'hard' in the final phase, while *learning to read words in books* remained in the 'middle' category. When asked why it was harder to read words on the computer than in books, Malcolm's comments suggested that he was concerned that computers do not have a bank of key words as one would expect to find in a school reading scheme. He reported, 'Books have certain words, and computer words are a little bit hard and sometimes you have to sound them out'.

This suggests that Malcolm perhaps prefers to learn to read print by acquiring a 'sight vocabulary' rather than having to 'sound out' words phonetically. This concurs with his mother's comments, who reported that Malcolm 'knows certain key words like "the" and "is"', but that for the most part would rely on picture clues to make meaning from print rather than attempt to sound out words. It therefore appears that Malcolm is highly dependent on his small bank of 'sight-read' words, in order to function as a perceived reader of text. While he evidently finds it hard to read his school books, he appears to get some degree of security from the fact that they do 'have certain words' that he knows he can read, thus allowing him to operate as a *reader* even if this is only partial. In other words, Malcolm now seems to believe that computer texts will do little to help him become 'a reader' as he sees 'reading' as the decoding of print in school-based books.

These data suggest that even though children like Caitlyn and Malcolm had developed skills in reading computer texts, including aspects of print reading, their confidence in handling print within these texts diminished over the course of the year. These children had found strategies of their own in which to make use of print within the multi-modal

context of the computer, but as they progressed through their early years of schooling they came to view print reading in more structured and isolated terms. This involved a perceived need to 'spell things' and to 'sound out' and to 'try and read' words. In other words, conformation to the schooled notion of reading, with its emphasis on the perceived need to decode print in books, was seen to threaten the children's own developing confidences in handling print.

This same issue was also evident in Joseph's profile. Not only did Joseph demonstrate a competence in using print within the context of the computer, he consistently reported that it was easier to read print on the computer than in books, during the first stage of the study. Yet even though Joseph remained highly enthusiastic about using computers throughout all phases of the study, his confidence in reading print on the computer seemed to decrease over the course of the study. For example, having rated *learning to read words on the computer* as 'easy' during the *Learning Skills* activity in Phase 1, this rating reduced to 'middle' in Phase 2 and 'hard' in Phase 3. As Joseph consistently categorised *learning to read words in books* as 'hard' throughout all three phases of this study, this suggests that Joseph came to regard print reading on the computer as being just as difficult as print reading within paper-based contexts.

It appears that Joseph was aware that the strategies he was using to make sense of print on the computer were different to the strategies he used elsewhere. For example, he reported that you 'have to understand words' to use the computer but later explained that a person does not have to be able to 'read' words to use it. He then went on to explain that even though it is not necessary to 'read words' on the computer, people 'have to listen to words though, so you know what you're doing'. It therefore appears that Joseph is stating that the multi-modal nature of computer texts means that the reader does not have to actually *decode* print in these texts as they can utilise other modes such as an auditory representation of the print. Yet Joseph's account also shows that he no longer recognises his own strategies to make use of print in computer texts as being authentic *reading*.

Discussion

This study supports the call for educators to 'develop curricula and pedagogy which enable children to build on their digital "funds of knowledge"' (Moll et al., 1992) (Marsh et al., 2005). Findings revealed that many of the children participating in this study had already developed skills to utilise a variety of digital texts with independence, before they began their formal education. Moreover, these digital 'funds of knowledge' appeared to include an ability to make sense of print within the holistic context of multi-modal reading. In other words, the context of digital media appeared to provide these children with opportunities to develop not only general understandings about how texts work, but allowed them to interact with print as part of the social semiotic structure of multi-modal text use. This supports Hassett's (2006) assertion that alphabetic print literacy now needs to be redefined within the school discourse on reading.

This study strongly suggests that the use of digital technology, and perhaps computer texts in particular, can provide territory for young children to learn how to use and make sense of print, within a context that is meaningful, motivating and free from issues of proficiency grading. Yet findings also revealed that as the children in this study progressed through their Reception year, many began to lose confidence in these

strategies, believing that they needed to conform to the perceived definition of reading as the need to decode printed text instead. In many cases this appeared to contribute towards the children losing confidence in themselves as *readers*.

In the first instance, this suggests that schools need to re-examine how formal and informal grading systems impact upon children's perceptions of themselves as readers of different texts today. Yet more specifically, the issues addressed in this paper indicate that early years educators need to not only offer children opportunities to develop their interactions with digital technologies in the classroom, but embrace the wide variety of ways in which children use strategies to make sense of paper and screen texts. This means that teachers working in early years settings need to actively encourage children to value the holistic strategies they use to read screen texts and make sense of print within these texts. For example, teachers can invite children to 'try out' the various options available to them on screen texts and encourage a use of 'trial and error' technique. In this respect children can be invited to regularly use print within the context of their screen reading, regardless of ability to decode. In doing so, teachers can find ways to build upon the strategies children have developed for themselves, rather than replace them with a narrow and constraining discourse.

Yet if schools are to find ways in which to build upon the sophisticated strategies that young children appear to be developing in order to make sense of digital texts, then more research is urgently needed in order to fully understand these strategies. While this paper has begun to shine light on this issue, it is imperative that further research is designed to deepen an understanding of exactly how young children read digital texts at home and at school. Such knowledge is crucial in order to inform curricula and pedagogy on the teaching of reading to 21st-century children.

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